

**BEST AVAILABLE COPY**

# PATENT ABSTRACTS OF JAPAN

(11) Publication number : 05-285348

(43) Date of publication of application : **02.11.1993**

(51)Int.CI.

B01D 63/02  
B01D 65/02

(21) Application number : 04-112225

(71)Applicant :

(22) Date of filing : **04.04.1992**

(72) Inventor :

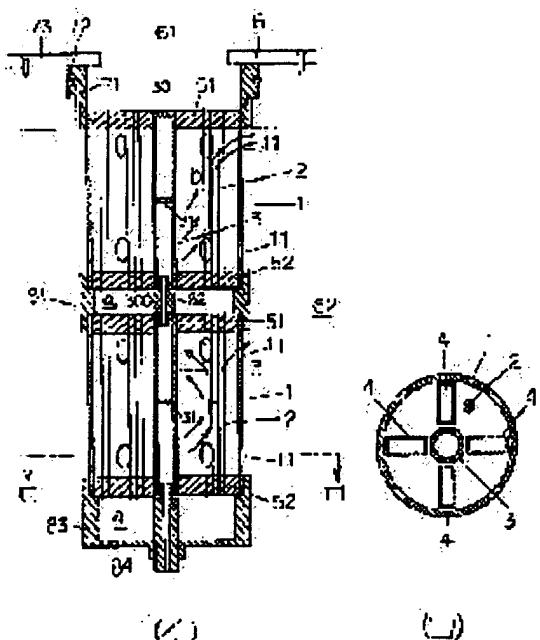
NITTO DENKO CORP  
KURODA TOSHIICHI  
TAWARA SHINJI  
ADACHI TETSURO  
NAKAGOME KEISUKE

## (54) VERTICAL TYPE HOLLOW FIBER MEMBRANE MODULE

(57) Abstract:

**PURPOSE:** To obtain a module stable for bending and torsion even when a hollow fiber membrane is washed by an air scrubbing method by providing a perforated air feed pipe in the center of an external cylinder and radially providing catchment pipes for the perforated air feed pipe.

**CONSTITUTION:** A perforated air feed pipe 3 is provided in the central position of a protective cylinder 1. Thereby, the pipe itself is low in mechanical strength but bending strain and torsional strain are practically regulated to the position of zero and therefore breakage is prevented. Further, catchment pipes 4 are radially provided around the perforated air feed pipe 3. Thereby, the cross-sectional secondary moment of the catchment pipes 4 is made large for bending moment and torsional moment and bending deformation and torsional deformation of a module are made small.



**LEGAL STATUS**

[Date of request for examination] 14.10.1998

[Date of sending the examiner's decision of rejection] 27.02.2001

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

(19)日本国特許庁 (JP)

(12) 公開特許公報 (A)

(11) 海特巴顿公司领导

特開平5-285348

(43)公開日 平成5年(1993)11月2日

(51) Int.Cl. 36010号 序内整理番号 F I  
B 01 D 63/02 6953-4D  
65/02 520 8014-4D 技術表示箇所

審査請求 未請求 請求項の数 2(全 4 頁)

(21) 出題番号 特題平4-112225

(22)出願日 平成4年(1992)4月4日

(71)出願人 000003964  
日東電工株式会社  
大阪府茨木市下籠横1丁目1番2号

(72)発明者 黒田 敏一  
大阪府茨木市下籠横1丁目1番2号 日東  
電工株式会社内

(72)発明者 田原 伸治  
大阪府茨木市下籠横1丁目1番2号 日東  
電工株式会社内

(72)発明者 安達 哲朗  
大阪府茨木市下籠横1丁目1番2号 日東  
電工株式会社内

(74)代理人 弁理士 松月 美勝

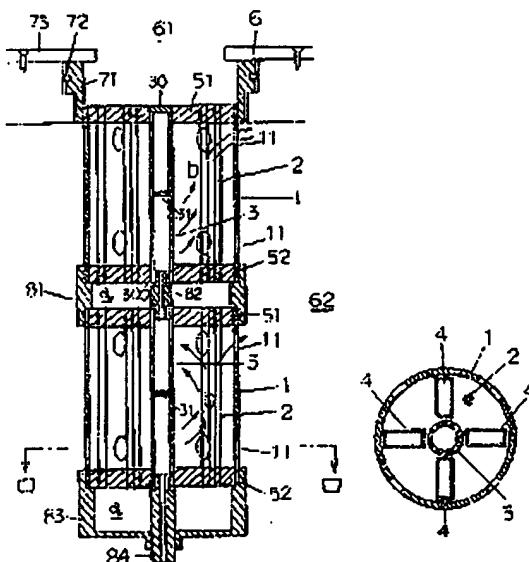
新編西遊記

(54)【登録の名称】 鋼製中空多層モジュール

(57) [要約]

【目的】エアスクラビング法により臓洗浄しても、モジュール全体の曲げ並びに捩じれに対する剛性を高くし、中空糸膜並びに孔開き送気管を曲げ、捩じれモーメントに対して安定に保持できる複型中空糸膜モジュールを提供する。

【構成】外筒内に複数本の中空糸膜が両端において接着剤で両端開口の状態で固定され、中空糸膜の下端側に透過液の集水部が存在し、該集水部を中空糸膜上端側に連通する集水管の上下端が上記接着剤によって上記外筒に固定され、エアスクラービング用空気の孔開き送気管の上下端が同上接着剤によって上記外筒に固定されてなる膜モジュールにおいて、上記孔開き送気管が外筒の中央に配設され、この孔開き送気管に対し集水管が放射状に配設されている。



1

1

1

## 【特許請求の範囲】

【請求項1】外筒内に複数本の中空糸膜が両端において接着剤で両端開口の状態で固定され、中空糸膜の下端側に透過液の集水部が存在し、該集水部を中空糸膜上端側に追道する集水管の上下端が上記接着剤によって上記外筒に固定され、エアスクラービング用空気の孔開き送気管の上下端が同上接着剤によって上記外筒に固定されてなる膜モジュールにおいて、上記孔開き送気管が外筒の中央に配設され、この孔開き送気管に対し集水管が放射状に配設されていることを特徴とする縦型中空糸膜モジュール。

【請求項2】請求項1記載の縦型中空糸膜モジュールが縦列配置され、外筒間が接続部材によって接続されると共に孔開き送気管が連通部材により追道され、各モジュールにおける孔開き送気管の途中に仕切が設けられることを特徴とする縦型中空糸膜モジュール。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】膜モジュール中、中空糸膜モジュールにおいては、単位体積当たりの膜面積を大きくとり得、また、縦型で設置することにより平面設置占有スペースを小さくできる。中空糸膜モジュールにおいては、かかる有利性のために、その用途は広範囲であり、例えば、原子力発電所、火力発電所の復水の効化に有用である。

【0002】図2はかかる用途に対する縦型中空糸膜モジュールの設置構造の一例を示している。図2において、M'は中空糸膜モジュールを示し、縦型保護筒1'内に複数本の中空糸膜2'と集水管4'と孔開き送気管3'とを収容し、その保護筒1'の両端にこれらの収容物2', 3', 4'の両端を両端開口状態で固定してある。ただし、上側モジュールにおける孔開き送気管3'の上端30'は閉塞してある。11'は保護筒1'に設けた原水供給孔である。6'は耐圧容器内を透過液室6'1'と原水室6'2'とに仕切る管板であり、上側モジュールを水密状態で懸垂支持し、当該上側モジュールの中空糸膜上端並びに集水管上端を透過液室6'1'に開通してある。8'はモジュールの接続部であり、保護筒1'、1'間を接続筒8'1'で水密に接続すると共に孔開き送気管3'、3'を追道管8'2'により気密に接続し、接続筒8'1'内に集水室a'を形成している。9'は下側モジュールの下端のキャップ部であり、保護筒1'にキャップ9'1'を水密に取着し、キャップ9'1'内に集水室a'を形成し、孔開き送気管3'の下端をエア導入管9'2'によりキャップ9'1'外に気密に引き出している。

【0003】上記モジュールによって、原水を通過するには、原水室6'2'に原水を圧入し、この圧入原水を保護筒1'内に原水供給孔11'から導入し、この導入原水を中空糸膜2'で通過する。この通過により生成した

2

透過液が中空糸膜2'内を上方向並びに下方向に向かって流動し、下方向透過液が一旦集水室a'で集水され、次いで、集水管4'により上側に導かれ、前記の直線上方向に向かって流動する透過液流れに合流され、下側モジュールにおける台流透過液は更に上側モジュールの集水管4'を通り、透過液室6'1'に透過液が流入していく。

【0004】上記において、集水管4'内の流通抵抗を中空糸膜2'内の流通抵抗に較べて著しく低くしてあり、集水管4'内での透過液の圧損を実質上、無視できるので、上記中空糸膜2'内での透過液の上下両方向への分流のために、透過液の圧損を実質上、中空糸膜長さの2分の1相当分に低減できる。

【0005】膜モジュールにおいては、使用時間の経過と共に膜表面へのスケールの付着によってクラッドが形成され、透過圧力の上昇、透過速度の低下が避けらず、透過圧力が所定圧力に達すると、膜洗浄を行う必要がある。そこで、上記の縦型中空糸膜モジュールにおいては、エア導入管9'2'より孔開き送気管3'内にエアを圧入し、この圧入エアを孔開き送気管3'の孔より気泡として各モジュールの保護筒1'内の原水中に放出させ、この気泡の中空糸膜2'への衝突並びに上昇気泡によって誘起される原水の対流によって中空糸膜表面のクラッドをスクラービングし、この剥離クラッドを各モジュールの保護筒下方の原水供給孔より排出すると共に気泡を保護筒上方の原水供給孔から流出させている。

## 【0006】

【発明が解決しようとする課題】しかしながら、上記の透過装置においては、縦型中空糸膜モジュールを縦列接続してあり、長尺であって、中空糸膜に作用する動揺力のためにモーメント（曲げモーメント並びに捩じりモーメント）が発生し、特に上側モジュールにおいては、著大なモーメントが作用するため、中空糸膜並びに孔開き送気管の曲げ破損、捩じれ破損が懸念される。本発明の目的は、エアスクラービング法により膜洗浄しても、モジュール全体の曲げ並びに捩じれに対する剛性を高くし、中空糸膜並びに孔開き送気管を曲げ、捩じれモーメントに対して安定に保持できる縦型中空糸膜モジュールを提供することにある。

## 【0007】

【課題を解決するための手段】本発明の縦型中空糸膜モジュールは、外筒内に複数本の中空糸膜が両端において接着剤で両端開口の状態で固定され、中空糸膜の下端側に透過液の集水部が存在し、該集水部を中空糸膜上端側に追道する集水管の上下端が上記接着剤によって上記外筒に固定され、エアスクラービング用空気の孔開き送気管の上下端が同上接着剤によって上記外筒に固定されてなる膜モジュールにおいて、上記孔開き送気管が外筒の中央に配設され、この孔開き送気管に対し集水管が放射状に配設されていることを特徴とする構成であり、縦列配

置で、外筒間を接続部材によって接続すると共に孔開き送気管を連通部材により追加して使用し、各モジュールにおける孔開き送気管の途中に仕切を設けることができる。

#### 【0008】

【作用】孔開き送気管においては、機械的強度が低いが、保護筒の中央位置、即ち、曲げ歪並びに捩じれ歪が実質上、零の位置に配設されているから、孔開き送気管の破損を防止できる。

【0009】また、集水管が孔開き送気管の周囲に放射状に配設されているから、曲げモーメント並びに捩じれモーメントに対する集水管の断面二次モーメントを大にでき、モジュールの曲げ変形並びに捩じれ変形を小さくできる。

#### 【0010】

【実施例】以下、図面により本発明の実施例を説明する。図1の(イ)は本発明の実施例を示す断面説明図、図1の(ロ)は図1の(イ)におけるローロ断面図である。図1の(イ)並びに図1の(ロ)において、1は断面円形の保護筒、11は保護筒内に設けた原水供給孔である。2は保護筒内に収納した中空糸膜、3は保護筒の中央に配設した孔開き送気管、4孔開き送気管3の周囲に放射状に配設した集水管であり、曲げ、並びに捩じりに対する断面二次モーメントの大なる断面形状、例えば、四角形としてある。

【0011】51は保護筒1の上端に設けた接着剤層、52は保護筒1の下端に設けた接着剤層であり、中空糸膜2、集水管4の各端を各端開口状態で保護筒1に水密に固定してある。また、孔開き送気管3に対しては、上側モジュールの孔開き送気管上端30は閉塞し、同孔開き送気管の下端30並びに下側モジュールの両端を開口状態にして同上接着層により保護筒に水密に固定してある。31は各孔開き送気管3の途中に設けた仕切である。

【0012】6は圧力容器(図示せず)を上側の透過液室61と下側の原水室62とに仕切った管板であり、上側モジュールの上端にヘッダー71を水密に取着し、このヘッダー71、0リング72、固定板73等によってモジュールを管板6に壁垂支持してある。

【0013】81は上下モジュールの保護筒1、1間に接続した接続筒であり、内部に集水室aを備えている。82は上下モジュールの孔開き送気管3、3相互を接続した連通管である。83は下側モジュールの下端に水密に取着したキャップであり、内部に集水室aを備えている。84は下側モジュールの孔開き送気管3の下端に気

密に差し込み接続したエア導入管であり、キャップ83の外部に水密に引き出している。

【0014】上記モジュールの膜洗浄はエアスクラビング法により行い、膜表面にスケールが付着してクラッドが形成され、透過圧が所定値に達すると、エア導入管84よりエアを送入する。この送入エアは下側モジュールから孔開き送気管を経て上側モジュールに送られていが、各モジュールにおける孔開き送気管3の途中に仕切31を設けてあるので、送入エアが下側から上側に一直線に素通りするのを排除でき、図1の(イ)の矢印で示すように、送入エアを各モジュールの保護筒1内の空間によく迂回させることができる。従って、各モジュールの保護筒内での上昇気泡の発生、この上昇気泡に基づく対流の発生をよく防ぐことができ、エアスクラビング法による膜洗浄を良好に行い得る。

#### 【0015】

【発明の効果】本発明の複型中空糸膜モジュールは上述した通りの構成であり、エアスクラビング法による膜洗浄時に曲げモーメントまたは捩じりモーメントを受けても、孔開き送気管を曲げ歪並びに捩じれ歪が実質上零の部位であるモジュールの中央に配設してあるから、孔開き送気管の機械的強度が低くても孔開き送気管の破損を防止できる。

【0016】また、集水管を孔開き送気管を中心にして放射状に配設して分散させてあるから、曲げ並びに捩じりに対する集水管の断面二次モーメントを大きくでき、モジュールの曲げ変形並びに捩じれ変形を少なくでき、機械的強度の低い膜を安定に保持できる。

#### 【図面の簡単な説明】

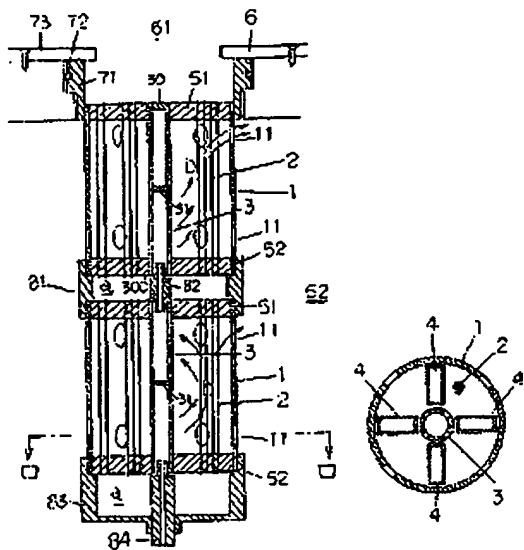
30 【図1】図1の(イ)は本発明の実施例を示す断面図、図1の(ロ)は図1の(イ)におけるローロ断面図である。

【図2】従来例を示す断面図である。

#### 【符号の説明】

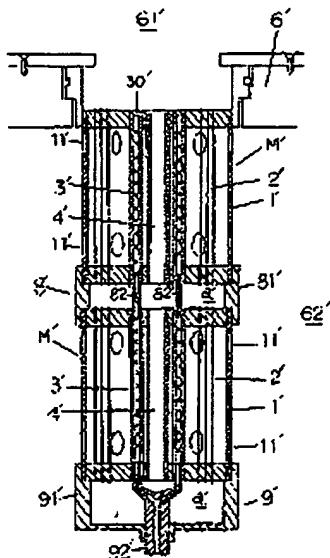
1	保護筒
2	中空糸膜
3	孔開き送気管
31	仕切
4	集水管
51	接着剤層
52	接着剤層
81	接続筒
82	連通管
a	集水室

【図1】



(1)

【図2】



(2)

フロントページの続き

(72)発明者 中込 敬祐  
 大阪府茨木市下猿崎1丁目1番2号 日東  
 電工株式会社内

\* NOTICES \*

JPO and NCIPI are not responsible for any  
damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
  2. \*\*\*\* shows the word which can not be translated.
  3. In the drawings, any words are not translated.
- 

CLAIMS

---

[Claim(s)]

[Claim 1] Two or more hollow fibers are fixed in the state of both-ends opening with adhesives in both ends in an outer case. The catchment section of transparency liquid exists in the lower limit side of a hollow fiber, and the vertical edge of catchment tubing which opens this catchment section for free passage to a hollow fiber upper limit side is fixed to the above-mentioned outer case by the above-mentioned adhesives. In the membrane module which comes to fix the vertical edge of the hole aperture airpipe of the air for air scrubbing to the above-mentioned outer case by adhesives same as the above The vertical mold hollow fiber module characterized by arranging the above-mentioned hole aperture airpipe in the center of an outer case, and arranging catchment tubing in a radial to this hole aperture airpipe.

[Claim 2] a hole [ in / column arrangement of the vertical mold hollow fiber module according to claim 1 is carried out, while between outer cases is connected by the connection member, a hole aperture airpipe is opened for free passage by the free passage member, and / each module ] -- an aperture airpipe -- on the way -- the vertical mold hollow fiber module characterized by being alike and preparing the batch.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPI are not responsible for any  
damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## DETAILED DESCRIPTION

---

### [Detailed Description of the Invention]

[0001]

[Industrial Application] In a hollow fiber module, a flat-surface installation occupancy tooth space can be made small among a membrane module by installing the film surface product per unit volume with the Li profit and a vertical mold as it is large. In a hollow fiber module, because of this profitableness, the application is wide range, for example, useful to purification of the condensation of a nuclear power plant and a thermal power station.

[0002] Drawing 2 shows an example of the installation structure of a vertical mold hollow fiber module to this application. drawing 2 -- setting -- M -- ' -- a hollow fiber -- a module -- being shown -- a vertical mold -- protection -- a cylinder -- one -- ' -- inside -- two or more -- a \*\* -- a hollow fiber -- two -- ' -- catchment -- tubing -- four -- ' -- a hole -- an aperture -- an airpipe -- three -- ' -- holding -- the -- protection -- a cylinder -- one -- ' -- both ends -- the both ends of these hold object 2', 3', and 4' -- a both-ends opening condition -- fixing -- \*\*\*\* . However, upper limit 30 of hole aperture airpipe 3" in a top module is blockaded. 11' is the raw water feed holes prepared in protection cylinder 1'. 6' is a tube plate with which the inside of a proof-pressure container is divided into transparency liquid room 61' and raw water room 62', carries out suspension support of the top module in the watertight condition, and is opened for traffic in catchment tubing upper limit in the hollow fiber upper limit list of the top module concerned at transparency liquid room 61'. 8' -- a modular connection -- it is -- protection cylinder 1' and 1' -- while connecting between watertight by connection cylinder 81' -- hole aperture airpipe 3' and 3' -- communicating tube 82' -- airtight -- connecting -- connection cylinder 81' -- catchment room a' is formed inside. 9' -- the cap section of the lower limit of a bottom module -- it is -- protection cylinder 1' -- cap 91' -- watertight -- attaching -- cap 91' -- inside -- catchment room a' -- forming -- the lower limit of hole aperture airpipe 3' -- air installation tubing 92' -- cap 91' -- it has pulled out airtightly outside.

[0003] for filtering raw water with the above-mentioned module -- raw water room 62' -- raw water -- pressing fit -- this press fit raw water -- protection cylinder 1' -- it introduces from raw water feed-holes 11' inside, and this introductory raw water is filtered by hollow fiber 2'. Inside is flowed toward down in an above list, and down transparency liquid is once caught by catchment room a'. the transparency liquid generated by this filtration -- hollow fiber 2' -- subsequently It is led to the bottom by catchment tubing 4', and the transparency liquid flow which flows toward direct above [ above ] is joined, the unification transparency liquid in a bottom module passes along catchment tubing 4' of a top module further, and transparency liquid flows into transparency liquid room 61'.

[0004] the above -- setting -- the circulation resistance in catchment tubing 4' -- hollow fiber 2' -- inner circulation resistance -- comparing -- remarkable -- low -- carrying out -- \*\*\*\* -- catchment tubing 4' -- since the pressure loss of the transparency liquid inside can be disregarded as a matter of fact -- above-mentioned hollow fiber 2' -- the pressure loss of transparency liquid can be reduced on parenchyma to the plane 1 present for 2 minutes of hollow fiber die length for splitting to the vertical both directions of the transparency liquid inside.

[0005] In a membrane module, a clad is formed of adhesion of the scale on the front face of the film with progress of a time, and if the rise of filtration pressure and the fall of filtration velocity avoid and \*\*\*\* and filtration pressure reach a predetermined pressure, it is necessary to perform film washing. Then, it sets to the

above-mentioned vertical mold hollow fiber module. It is made to emit into inner raw water. air installation tubing 92' -- hole aperture airpipe 3' -- inside -- air -- pressing fit -- this press fit air -- the hole of hole aperture airpipe 3' -- as air bubbles -- protection cylinder 1' of each module -- While carrying out scrubbing of the clad on the front face of a hollow fiber and discharging this exfoliation clad from the raw water feed holes of the protection cylinder lower part of each module by the convection current of raw water by which induction is carried out to the collision list to hollow fiber 2' of these air bubbles with rise air bubbles, air bubbles are made to flow out of the raw water feed holes of the protection cylinder upper part.

[0006]

[Problem(s) to be Solved by the Invention] However, in the above-mentioned filter, in especially a top module, in order that the \*\*\*\*\* moment may act, a hollow fiber list is anxious [ column connection of the vertical mold hollow fiber module is made, and / it is a long picture, the moment (it twists in a bending moment list and is the moment) occurs for the agitation force of acting on a hollow fiber, and ] about bending breakage of a hole aperture airpipe, and twist breakage. Even if the purpose of this invention carries out film washing by the air scrubbing method, it makes rigidity over a twist high at the bending list of the whole module, and is to offer the vertical mold hollow fiber module which can hold a hole aperture airpipe to stability to bending and the twist moment at a hollow fiber list.

[0007]

[Means for Solving the Problem] As for the vertical mold hollow fiber module of this invention, two or more hollow fibers are fixed in the state of both-ends opening with adhesives in both ends in an outer case. The catchment section of transparency liquid exists in the lower limit side of a hollow fiber, and the vertical edge of catchment tubing which opens this catchment section for free passage to a hollow fiber upper limit side is fixed to the above-mentioned outer case by the above-mentioned adhesives. In the membrane module which comes to fix the vertical edge of the hole aperture airpipe of the air for air scrubbing to the above-mentioned outer case by adhesives same as the above It is the configuration characterized by arranging the above-mentioned hole aperture airpipe in the center of an outer case, and arranging catchment tubing in a radial to this hole aperture airpipe. By column arrangement a hole [ in / while connecting between outer cases by the connection member, a hole aperture airpipe is used being open for free passage with a free passage member, and / each module ] -- an aperture airpipe -- on the way -- it can be alike and a batch can be prepared.

[0008]

[Function] although a mechanical strength is low, since it is twisted, the mid gear, i.e., the bending distorted list, of a protection cylinder, and distortion is arranged in the location of zero on parenchyma in the hole aperture airpipe -- a hole -- breakage of an aperture airpipe can be prevented.

[0009] Moreover, since catchment tubing is arranged in the perimeter of a hole aperture airpipe by the radial, it is twisted in a bending moment list, and the second moment of area of catchment tubing to the moment is made to size, it is twisted in a modular bending deformation list, and deformation can be made small.

[0010]

[Example] Hereafter, a drawing explains the example of this invention. (b) of the cross-section explanatory view in which (b) of drawing 1 shows the example of this invention, and drawing 1 is the Law RO sectional view in (b) of drawing 1 . They are the raw water feed holes which prepared 1 in the protection cylinder of a cross-section round shape, and prepared 11 in the protection cylinder in (b) of drawing 1 at the (b) list of drawing 1 . the hollow fiber which contained 2 in the protection cylinder, and the hole which arranged 3 in the center of a protection cylinder -- a second moment of area [ as opposed to / are an aperture airpipe and catchment tubing arranged in the surroundings of the aperture airpipe 3 4 hole at the radial, and / a twist to bending and a list ] -- size -- it has carried out to the cross-section configuration, for example, a square.

[0011] It is the adhesives layer which prepared 51 in the upper limit of the protection cylinder 1, and the adhesives layer which prepared 52 in the lower limit of the protection cylinder 1, and each edge of a hollow fiber 2 and the catchment tubing 4 is fixed to the protection cylinder 1 watertight in the state of each edge opening. moreover, a hole -- the aperture airpipe 3 -- receiving -- the hole aperture airpipe upper limit 30 of a top module -- blockading -- said -- the both ends of a bottom module are changed into an opening condition at the lower limit 300 list of a hole aperture airpipe, and it has fixed to the protection cylinder watertight by the glue line same as the above. 31 -- each -- the hole aperture airpipe 3 -- on the way -- it is the batch boiled and prepared.

[0012] 6 is the tube plate with which the pressurized container (not shown) was divided into the upper transparency liquid room 61 and the lower raw water room 62, attaches a header 71 in the upper limit of a top module watertight, and has carried out suspension support of the module at the tube plate 6 by this header 71, zero ring 72, and stationary-plate 73 grade.

[0013] 81 is the protection cylinder 1 of a vertical module, and the connection cylinder which connected between one, and equips the interior with the catchment room a. 82 is the hole aperture airpipe 3 of a vertical module, and the communicating tube which connected both three. 83 is the cap attached in the lower limit of a bottom module watertight, and equips the interior with the catchment room a. 84 is air installation tubing which fitted over the lower limit of the hole aperture airpipe 3 of a bottom module airtightly, and was connected, and is pulled out watertight to the exterior of cap 83.

[0014] If film washing of the above-mentioned module is performed by the air scrubbing method, a scale adheres to a film front face, a clad is formed and filtration pressure reaches a predetermined value, air will be fed from the air installation tubing 84. this feeding air should pass a hole aperture airpipe from a bottom module -- the hole in each module although sent to the top module -- the aperture airpipe 3 -- on the way -- since it is alike and the batch 31 is formed, as it can eliminate that feeding air bypasses from the bottom in a straight line to the up side and the arrow head b of (b) of drawing 1 shows it, feeding air can often be detoured to the space in the protection cylinder 1 of each module. Therefore, generating of the convection current based on generating of the rise air bubbles within the protection cylinder of each module and these rise air bubbles can be secured well, and film washing by the air scrubbing method can be performed good.

[0015]

[Effect of the Invention] even if the vertical mold hollow fiber module of this invention is a configuration as mentioned above and receives the bending moment or the torsion moment at the time of film washing by the air scrubbing method -- a hole -- since an aperture airpipe is twisted in a bending distorted list and it has arranged in the modular center whose distortion is the part of parenchyma top zero -- a hole -- even if the mechanical strength of an aperture airpipe is low, breakage of a hole aperture airpipe can be prevented.

[0016] Moreover, since the radial is made to have arranged and distributed catchment tubing centering on a hole aperture airpipe, the second moment of area of catchment tubing to a twist can be enlarged at a bending list, it is twisted in a modular bending deformation list, deformation can be lessened, and the low film of a mechanical strength can be held to stability.

---

[Translation done.]

\* NOTICES \*

JPO and NCIP are not responsible for any  
damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## TECHNICAL FIELD

---

[Industrial Application] In a hollow fiber module, a flat-surface installation occupancy tooth space can be made small among a membrane module by installing the film surface product per unit volume with the Li profit and a vertical mold as it is large. In a hollow fiber module, because of this profitableness, the application is wide range, for example, useful to purification of the condensation of a nuclear power plant and a thermal power station.

[0002] Drawing 2 shows an example of the installation structure of a vertical mold hollow fiber module to this application. drawing 2 -- setting -- M -- ' -- a hollow fiber -- a module -- being shown -- a vertical mold -- protection -- a cylinder -- one -- ' -- inside -- two or more -- a \*\* -- a hollow fiber -- two -- ' -- catchment -- tubing -- four -- ' -- a hole -- an aperture -- an airpipe -- three -- ' -- holding -- the -- protection -- a cylinder -- one -- ' -- both ends -- the both ends of these hold object 2', 3', and 4' -- a both-ends opening condition -- fixing -- \*\*\*\* . However, upper limit 30 of hole aperture airpipe 3" in a top module is blockaded. 11' is the raw water feed holes prepared in protection cylinder 1'. 6' is a tube plate with which the inside of a proof-pressure container is divided into transparency liquid room 61' and raw water room 62', carries out suspension support of the top module in the watertight condition, and is opened for traffic in catchment tubing upper limit in the hollow fiber upper limit list of the top module concerned at transparency liquid room 61'. 8' -- a modular connection -- it is -- protection cylinder 1' and 1' -- while connecting between watertight by connection cylinder 81' -- hole aperture airpipe 3' and 3' -- communicating tube 82' -- airtight -- connecting -- connection cylinder 81' -- catchment room a' is formed inside. 9' -- the cap section of the lower limit of a bottom module -- it is -- protection cylinder 1' -- cap 91' -- watertight -- attaching -- cap 91' -- inside -- catchment room a' -- forming -- the lower limit of hole aperture airpipe 3' -- air installation tubing 92' -- cap 91' -- it has pulled out airtightly outside.

[0003] for filtering raw water with the above-mentioned module -- raw water room 62' -- raw water -- pressing fit -- this press fit raw water -- protection cylinder 1' -- it introduces from raw water feed-holes 11' inside, and this introductory raw water is filtered by hollow fiber 2'. Inside is flowed toward down in an above list, and down transparency liquid is once caught by catchment room a'. the transparency liquid generated by this filtration -- hollow fiber 2' -- subsequently It is led to the bottom by catchment tubing 4', and the transparency liquid flow which flows toward direct above [ above ] is joined, the unification transparency liquid in a bottom module passes along catchment tubing 4' of a top module further, and transparency liquid flows into transparency liquid room 61'.

[0004] the above -- setting -- the circulation resistance in catchment tubing 4' -- hollow fiber 2' -- inner circulation resistance -- comparing -- remarkable -- low -- carrying out -- \*\*\*\* -- catchment tubing 4' -- since the pressure loss of the transparency liquid inside can be disregarded as a matter of fact -- above-mentioned hollow fiber 2' -- the pressure loss of transparency liquid can be reduced on parenchyma to the plane 1 present for 2 minutes of hollow fiber die length for splitting to the vertical both directions of the transparency liquid inside.

[0005] In a membrane module, a clad is formed of adhesion of the scale on the front face of the film with progress of a time, and if the rise of filtration pressure and the fall of filtration velocity avoid and \*\*\*\* and filtration pressure reach a predetermined pressure, it is necessary to perform film washing. Then, it sets to the above-mentioned vertical mold hollow fiber module. It is made to emit into inner raw water. air installation tubing 92' -- hole aperture airpipe 3' -- inside -- air -- pressing fit -- this press fit air -- the hole of hole aperture

airpipe 3' -- as air bubbles -- protection cylinder 1' of each module -- While carrying out scrubbing of the clad on the front face of a hollow fiber and discharging this exfoliation clad from the raw water feed holes of the protection cylinder lower part of each module by the convection current of raw water by which induction is carried out to the collision list to hollow fiber 2' of these air bubbles with rise air bubbles, air bubbles are made to flow out of the raw water feed holes of the protection cylinder upper part.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPI are not responsible for any  
damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
  2. \*\*\*\* shows the word which can not be translated.
  3. In the drawings, any words are not translated.
- 

## EFFECT OF THE INVENTION

---

[Effect of the Invention] even if the vertical mold hollow fiber module of this invention is a configuration as mentioned above and receives the bending moment or the torsion moment at the time of film washing by the air scrubbing method -- a hole -- since an aperture airpipe is twisted in a bending distorted list and it has arranged in the modular center whose distortion is the part of parenchyma top zero -- a hole -- even if the mechanical strength of an aperture airpipe is low, breakage of a hole aperture airpipe can be prevented.

[0016] Moreover, since the radial is made to have arranged and distributed catchment tubing centering on a hole aperture airpipe, the second moment of area of catchment tubing to a twist can be enlarged at a bending list, it is twisted in a modular bending deformation list, deformation can be lessened, and the low film of a mechanical strength can be held to stability.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPI are not responsible for any  
damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## TECHNICAL PROBLEM

---

[Problem(s) to be Solved by the Invention] However, in the above-mentioned filter, in especially a top module, in order that the \*\*\*\*\* moment may act, a hollow fiber list is anxious [ column connection of the vertical mold hollow fiber module is made, and / it is a long picture, the moment (it twists in a bending moment list and is the moment) occurs for the agitation force of acting on a hollow fiber, and ] about bending breakage of a hole aperture airpipe, and twist breakage. Even if the purpose of this invention carries out film washing by the air scrubbing method, it makes rigidity over a twist high at the bending list of the whole module, and is to offer the vertical mold hollow fiber module which can hold a hole aperture airpipe to stability to bending and the twist moment at a hollow fiber list.

---

[Translation done.]

\* NOTICES \*

JPO and NCIP are not responsible for any  
damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## MEANS

---

[Means for Solving the Problem] As for the vertical mold hollow fiber module of this invention, two or more hollow fibers are fixed in the state of both-ends opening with adhesives in both ends in an outer case. The catchment section of transparency liquid exists in the lower limit side of a hollow fiber, and the vertical edge of catchment tubing which opens this catchment section for free passage to a hollow fiber upper limit side is fixed to the above-mentioned outer case by the above-mentioned adhesives. In the membrane module which comes to fix the vertical edge of the hole aperture airpipe of the air for air scrubbing to the above-mentioned outer case by adhesives same as the above It is the configuration characterized by arranging the above-mentioned hole aperture airpipe in the center of an outer case, and arranging catchment tubing in a radial to this hole aperture airpipe. By column arrangement a hole [ in / while connecting between outer cases by the connection member, a hole aperture airpipe is used being open for free passage with a free passage member, and / each module ] -- an aperture airpipe -- on the way -- it can be alike and a batch can be prepared.

---

[Translation done.]

\* NOTICES \*

JPO and NCIP are not responsible for any  
damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## OPERATION

---

[Function] although a mechanical strength is low, since it is twisted, the mid gear, i.e., the bending distorted list, of a protection cylinder, and distortion is arranged in the location of zero on parenchyma in the hole aperture airpipe -- a hole -- breakage of an aperture airpipe can be prevented.

[0009] Moreover, since catchment tubing is arranged in the perimeter of a hole aperture airpipe by the radial, it is twisted in a bending moment list, and the second moment of area of catchment tubing to the moment is made to size, it is twisted in a modular bending deformation list, and deformation can be made small.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPI are not responsible for any  
damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

EXAMPLE

---

[Example] Hereafter, a drawing explains the example of this invention. (b) of the cross-section explanatory view in which (b) of drawing 1 shows the example of this invention, and drawing 1 is the Law RO sectional view in (b) of drawing 1. They are the raw water feed holes which prepared 1 in the protection cylinder of a cross-section round shape, and prepared 11 in the protection cylinder in (b) of drawing 1 at the (b) list of drawing 1. the hollow fiber which contained 2 in the protection cylinder, and the hole which arranged 3 in the center of a protection cylinder -- a second moment of area [ as opposed to / are an aperture airpipe and catchment tubing arranged in the surroundings of the aperture airpipe 3 4 hole at the radial, and / a twist to bending and a list ] -- size -- it has carried out to the cross-section configuration, for example, a square. [0011] It is the adhesives layer which prepared 51 in the upper limit of the protection cylinder 1, and the adhesives layer which prepared 52 in the lower limit of the protection cylinder 1, and each edge of a hollow fiber 2 and the catchment tubing 4 is fixed to the protection cylinder 1 watertight in the state of each edge opening. moreover, a hole -- the aperture airpipe 3 -- receiving -- the hole aperture airpipe upper limit 30 of a top module -- blockading -- said -- the both ends of a bottom module are changed into an opening condition at the lower limit 300 list of a hole aperture airpipe, and it has fixed to the protection cylinder watertight by the glue line same as the above. 31 -- each -- the hole aperture airpipe 3 -- on the way -- it is the batch boiled and prepared.

[0012] 6 is the tube plate with which the pressurized container (not shown) was divided into the upper transparency liquid room 61 and the lower raw water room 62, attaches a header 71 in the upper limit of a top module watertight, and has carried out suspension support of the module at the tube plate 6 by this header 71, zero ring 72, and stationary-plate 73 grade.

[0013] 81 is the protection cylinder 1 of a vertical module, and the connection cylinder which connected between one, and equips the interior with the catchment room a. 82 is the hole aperture airpipe 3 of a vertical module, and the communicating tube which connected both three. 83 is the cap attached in the lower limit of a bottom module watertight, and equips the interior with the catchment room a. 84 is air installation tubing which fitted over the lower limit of the hole aperture airpipe 3 of a bottom module airtightly, and was connected, and is pulled out watertight to the exterior of cap 83.

[0014] If film washing of the above-mentioned module is performed by the air scrubbing method, a scale adheres to a film front face, a clad is formed and filtration pressure reaches a predetermined value, air will be fed from the air installation tubing 84. this feeding air should pass a hole aperture airpipe from a bottom module -- the hole in each module although sent to the top module -- the aperture airpipe 3 -- on the way -- since it is alike and the batch 31 is formed, as it can eliminate that feeding air bypasses from the bottom in a straight line to the up side and the arrow head b of (b) of drawing 1 shows it, feeding air can often be detoured to the space in the protection cylinder 1 of each module. Therefore, generating of the convection current based on generating of the rise air bubbles within the protection cylinder of each module and these rise air bubbles can be secured well, and film washing by the air scrubbing method can be performed good.

---

[Translation done.]

\* NOTICES \*

JPO and NCIP are not responsible for any  
damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
  2. \*\*\*\* shows the word which can not be translated.
  3. In the drawings, any words are not translated.
- 

## DESCRIPTION OF DRAWINGS

---

[Brief Description of the Drawings]

[Drawing 1] (b) of the sectional view in which (b) of drawing 1 shows the example of this invention, and  
drawing 1 is the Law RO sectional view in (b) of drawing 1.

[Drawing 2] It is the sectional view showing the conventional example.

[Description of Notations]

1 Protection Cylinder

2 Hollow Fiber

3 Drilling Airpipe

31 Batch

4 Catchment Tubing

51 Adhesives Layer

52 Adhesives Layer

81 Connection Cylinder

82 Communicating Tube

Catchment room

---

[Translation done.]

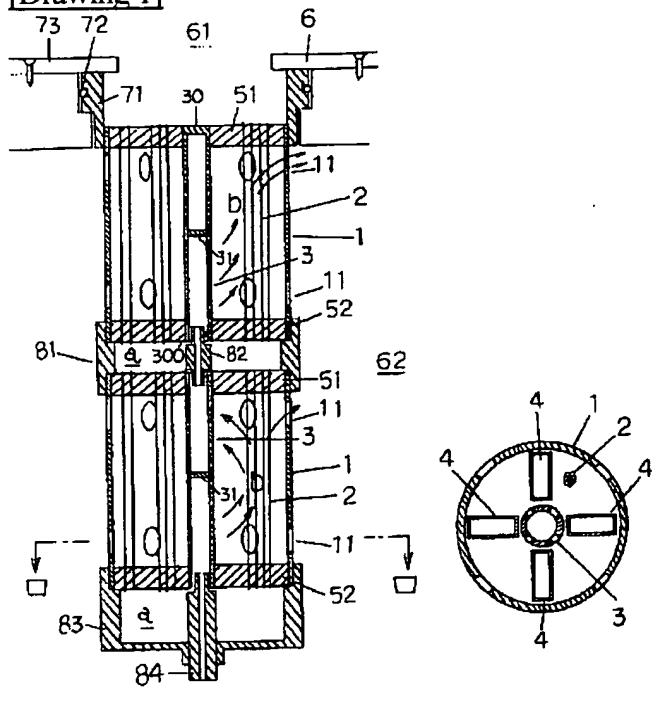
\* NOTICES \*

JPO and NCIPPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
  2. \*\*\*\* shows the word which can not be translated.
  3. In the drawings, any words are not translated.

## DRAWINGS

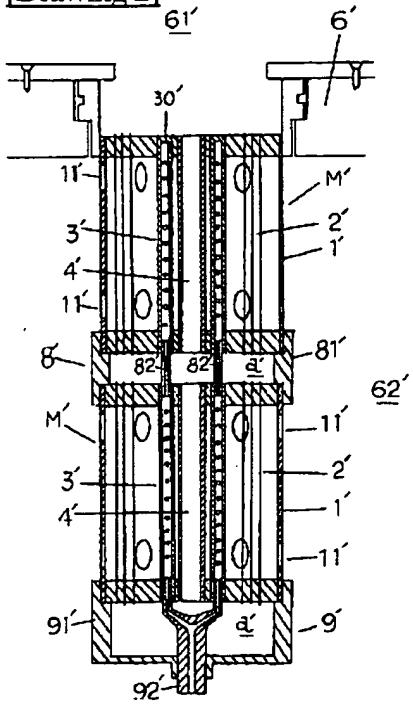
### [Drawing 1]



(1)

(□)

[Drawing 2]



---

[Translation done.]

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER: \_\_\_\_\_**

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**